

Appl. No. 09/715,690
Amdt. dated May 19, 2003
Reply to Office Action of March 17, 2003

REMARKS

Claim Rejections - 35 U.S.C. § 103

The Examiner has rejected claims 1, 4, 6-11 and 16 under 35 U.S.C. 103(a) as being unpatentable over Kaufman et al. (U.S. Patent No. 5,954,997) in view of Feller et al. (U.S. Patent No. 5,700,383) and further in view of Grumbine et al. (U.S. Patent No. 6,083,419). Furthermore, the Examiner has rejected claims 5, 12, and 15 under 35 U.S.C. 103(a) as being unpatentable over the combination of Kaufman, Feller, and Grumbine as applied to claims 1, 4, 6-11 and 16 above and further in view of various combinations of Neville et al. (U.S. Patent No. 5,527,423), Kato et al. (U.S. Patent No. 5,904,159), and Tsai et al. (U.S. Patent No. 5,575,706).

The Applicant respectfully traverses. It would not be obvious to formulate a slurry containing a surfactant containing an alkyltrimethylammonium cation; a chelating buffer system; an abrasive; an oxidizer; and a corrosion inhibitor; wherein the slurry has a pH between 2.5 and 7.0 as claimed by the Applicant in independent claims 1 and 11 in light of the cited references, and in particular in light of Kaufman. This is because the interaction between the alkyltrimethyl ammonium cations and the abrasive within the claimed pH range of 2.5 and 7.0 destabilizes the Applicant's slurry. Specifically, the negatively charged abrasive (such as silica) is attracted to the positively charged alkyltrimethylammonium cations resulting in clumping (flocculation) of the abrasive. Therefore it would not be obvious to purposely formulate a destabilized slurry in light of the Kaufman reference that expressly teaches stabilized slurry formulations. In particular Kaufman teaches that "[i]n order to promote stabilization of a CMP slurry of this invention against settling, flocculation, and decomposition, a variety of optional CMP slurry additives, such as surfactants...can be used." (Col.6 lines 34-38) Therefore, a surfactant such as the Applicant's surfactant containing alkyltrimethylammonium cations would not be suitable for the stabilization of a

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CMP slurry as taught by Kaufman. The Applicant respectfully submits that because the rejections of the claims are all based on Kaufman in combination with other references, that none of the claims are obvious in light of the cited references.

Additionally, the Applicant's slurry formulation is not obvious because the advantages of the Applicant's slurry are unexpected and therefore unsuggested by the references. The results are surprising in light of the fact that the formulation used by the Applicant is destabilizing and slightly decreases the copper removal rate which is not optimal for a copper polish slurry. An advantage of the Applicant's slurry is that there is a substantial decrease in the pattern sensitive erosion rate of the interlayer dielectric in 90% dense copper interconnect structures. Figure 3 of the Applicant's patent application shows this result, where the ILD erosion rate without the alkyltrimethylammonium cations is approximately 4025 Å/min and the ILD erosion rate with the alkyltrimethylammonium cations is 431 Å/min. Therefore, although the surfactant will destabilize the slurry and reduce the copper polish rate, it also provides the unexpected result of dramatically reducing the ILD erosion rate of high density copper interconnect structures.

The Applicant respectfully submits that the Applicant's claims 1, 4, 6-11 and 16 are not made obvious in light of the cited references, either individually or in combination.

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Respectfully submitted,

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5/19/03

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